

Amendments to the Specification

The paragraph starting at page 1, line 15 and ending at page 2, line 7 has been amended as follows.

In recent years, the range of use of an ink jet recording apparatus has widened with a rise in its utilization value, and the types of it ink jet recording apparatus have been ~~seen in a tendency toward an increase~~ increasing, such as an ink jet recording apparatus characterized by a high quality of photographic image, an ink jet recording apparatus used chiefly for black character recording, which uses a pigment ink for black alone to emphasize the distinctness of black and uses inks of other colors formed of dyes, and further an ink jet recording apparatus characterized by a low price. With the increase in the types of machine, the types of an ink jet recording head as the heart for discharging ink to thereby record an image have also increased, and individual discharge recovering ~~apparatus~~ apparatuses corresponding to respective ~~ones of them~~ heads have become required, and technical problems to be solved such as ~~the badness of poor~~ design efficiency and ~~productive~~ production efficiency, and a rise in cost resulting therefrom have also arisen.

The paragraph starting at page 2, line 8 and ending at page 3, line 8 has been amended as follows.

Fig. 15 of the accompanying drawings is a typical perspective view showing an example of the discharge recovering apparatus of an ink jet recording apparatus according to the prior art, Fig. 16 of the accompanying drawings is a typical perspective view showing an example of the internal structure of the discharge recovering apparatus of Fig. 15, and Fig. 17 of the accompanying drawings is a typical perspective view showing another example of the internal structure of the discharge recovering apparatus of Fig. 15. In Fig. 15, when as the suction means 61 of the discharge recovering apparatus 6, use is made of a tube pump of a type in which a tube ~~creeping~~ disposed along an arcuate guide portion (guide surface) is squeezed by a pressing roller journaled to a rotary member to thereby generate negative pressure (suction force), there is adopted a method of incorporating this tube along the arcuate guide surface by the cooperation thereof with the pressing roller, and this is advantageous for the downsizing of the apparatus and the curtailment of the number of parts, and therefore, a base member (recovering base) for mounting the various parts of the discharge recovering apparatus and the guide portion are constituted by a single part. That is, ~~adopted~~ a construction is adopted in which the guide portion is formed on a portion of the base member of the discharge recovering apparatus.

The paragraph starting at page 3, line 9 and ending at page 4, line 6 has been amended as follows.

Some of various ink jet recording heads to which the discharge recovering apparatus imparts the discharge recovering action have various functions as previously

described. First, the ink jet recording head carried on the ink jet recording apparatus characterized by the high quality of photographic ~~image~~, image is required to minimize the amount of ink discharged from a discharge port, and the opening diameter of the discharge port is a small diameter, and correspondingly thereto, discharge ports are arranged highly densely and the number of the discharge ports is great. Therefore, when in the discharge recovering apparatus, in a capping state in which a cap is brought into close contact with a surface (discharge port surface) formed with a plurality of discharge ports, the interior of the cap is brought into a negative pressure state and ink is drawn out of each discharge port, it is necessary to make great negative pressure act, and a suction pump for generating the great negative pressure becomes necessary. For such a recording head, a tube pump 61 having two lines of tube 616 is connected to a cap 621, as shown in Fig. 16, to thereby make the negative pressure acting on the interior of the cap 621 great.

The paragraph starting at page 4, line 7 and ending at page 5, line 1 has been amended as follows.

Also, in the ink jet recording apparatus for effecting chiefly black character recording, which uses a pigment ink for black alone to emphasize the distinctness of black and uses inks of other colors formed of dyes, when suction recovery is to be effected by the discharge recovering apparatus, it is necessary to ~~such~~ suck the inks individually so that the pigment and the dyes may not mix with one another. Therefore, ~~there is done a contrivance of providing~~ a plurality of caps is provided, or ~~dividing~~ a closed space in one cap is divided

into ~~two in one cap two~~. Such a recording head is ~~coped with~~ handled by using a tube pump 61 having two lines of tubes 616 similar to those in Fig. 16, and divisionally connecting respective ones of the two lines of tubes to two caps 621a and 621b as shown in Fig. 17. By such a contrivance the discharge recovering apparatus corresponding to the aforescribed two types of recording heads can be made with only the difference in parts between Fig. 16 and Fig. 17, and the mitigation of the ~~badness of~~ poor design efficiency and production efficiency and a rise in cost resulting therefrom is achieved.

The paragraph starting at page 5, line 2 and ending at line 24 has been amended as follows.

However, the aforescribed ink jet recording apparatus, and the discharge recovering ~~apparatus~~, apparatus and the tube pump (pump unit) which are the constituents thereof, have suffered from such technical ~~programs~~ problems to be solved, as will be described below. That is, in the incorporating of the tubes in the tube pump, there is adopted a method of ~~incorporation~~ incorporating the tubes along an arcuate guide surface for crushing the tubes by the cooperation with the pressure roller. However, when the tubes are shifted in an attempt to adjust the mounted positions of the tubes when bringing the tubes along the inner side of the arcuate portion, there occurs the action of the tubes restoring to their straight state, and the tubes have stuck on the guide surface or have floated up from the guide surface and the state of the tubes has not been stable, and the assembling ~~work for~~ of the tubes has been very difficult. This has resulted in the technical

problem that the tubes are liable to be incorporated in a positionally deviated state, a slack state, a buckled state or a twisted state, and erroneous incorporation is liable to occur.

The paragraph starting at page 6, line 19 and ending at page 7, line 19 has been amended as follows.

Also, the base member on which the various parts of the discharge recovering apparatus are mounted and the aforementioned guide ~~surface~~, surface are constituted by a single part so as to be advantageous for the downsizing of the apparatus and the curtailment of the number of parts, but since high rigidity and high dimensional accuracy are required of the base member of the discharge recovering apparatus, it is necessary to make the base member by the use of a glass-containing material. Also, in the discharge recovering apparatus of the ink jet recording apparatus according to the prior art, use is made of a construction in which the rotary member is directly rotatably supported by the base member, but the glass-containing material lacks slidability and therefore, when the rotary member is rotated under the great reaction force of the pressure force of the tubes, there arise inconveniences that a great load is produced, the shaving of the material occurs and the shaved powder comes into a sliding portion to thereby cause abnormal sound, and this has led to the technical problem that the application of grease becomes necessary as a ~~countermeasure for that~~ countermeasure. In the discharge recovering apparatus, it is required to decrease the application of grease as ~~far~~ much as possible from the viewpoint

that if the grease adheres to the cap or a wiper, it may close the discharge ports of the recording head.

The paragraph starting at page 8, line 13 and ending at line 21 has been amended as follows.

It is an object of the present invention to provide a tube pump which is made separable in the state of a pump unit to thereby facilitate the incorporation of a tube, and easily eliminate the erroneous incorporation of ~~incorporating~~ the tube in a buckled state or a twisted state, a discharge recovering apparatus using the tube pump, and an ink jet recording apparatus provided with the discharge recovering apparatus.

The paragraph starting at page 9, line 4 and ending at line 16 has been amended as follows.

It is another object of the present invention to provide a tube pump in which the direct sliding movement of a guide member and a rotary member can be avoided without a bearing being added, and an increase in the load of the sliding region of a rotary member supporting member, the occurrence of abrasion and the production of abnormal sound can be prevented without ~~the occurrence of~~ an increase in the cost of the parts, and which can eliminate the necessity of applying grease, a discharge recovering apparatus

using the tube pump, and an ink jet recording apparatus provided with the discharge recovering apparatus.

The paragraph starting at page 10, line 25 and ending at page 11, line 14 has been amended as follows.

The present invention adopts, in a tube pump for generating negative pressure in a tube, a construction which is provided with a tube disposed along an arcuate guide portion, a pressing roller for squeezing the tube, a rotary member to which the pressing roller is rotatably journalled, and a supporting member to which the rotary member is rotatably journalled, and in which the tube, the pressing roller, the rotary member and the rotary member supporting member are assembled to thereby form a pump unit, and are made separable from the guide portion in the state of the pump unit, and therefore there is provided a tube pump in which the incorporation of the tube is easy and the erroneous incorporation of ~~incorporating~~ the tube in its buckled state or its twisted state can be eliminated easily.

The paragraph starting at page 15, line 6 and ending at page 16, line 5 has been amended as follows.

The sheet feeding portion 2 is comprised of a pressure plate 21 for stacking sheet materials P thereon, a sheet feeding roller 28 for feeding the sheet materials P, a

separating roller 241 for separating the sheet materials P, a returning lever 22 for returning the sheet materials P to a stacking position, etc., mounted on a base 20 (Fig. 3). The sheet feeding roller 28 is of a bar shape having an arcuate ~~cross-section~~ cross-section, and this sheet feeding roller 28 is provided with separating roller rubber (sheet feeding roller rubber) 281 toward ~~sheet reference~~ the sheet. The feeding of the sheet material is effected by such a sheet feeding roller 28. The driving of the sheet feeding roller 28 is effected by a driving force transmitted from a sheet feeding motor 273 for exclusive use provided in the sheet feeding portion 2 through a drive transmitting gear. A movable side guide 23 is provided on the pressure plate 21 movably in the widthwise direction of the recording material, and regulates the stacking position of the sheet materials P. The pressure plate 21 is rotatable about a rotary shaft coupled to the base 20, and is biased toward the sheet feeding roller 28 by a pressure plate spring 212. The pressure plate 21 is designed to be capable of being brought into contact with and spaced apart from the sheet feeding roller 28 by a pressure plate cam (not shown).

The paragraph starting at page 16, line 6 and ending at page 17, line 5 has been amended as follows.

Further, a separating roller holder 24 having mounted thereon the separating roller 241 for separating the sheet materials P one by one is mounted on the base 20. This separating roller holder 24 is pivotally movable about a rotary shaft provided on the base 20 and is mounted while being biased toward the sheet feeding roller 28 by a separating

roller spring 242. A separating roller clutch (clutch ~~spring~~, ~~not shown~~ spring) (~~not shown~~) is mounted on the separating roller 241, and design is made such that when a predetermined or greater load is applied to the separating roller 241, a portion on which the separating roller 241 is mounted can rotate. The separating roller 241 is designed to be capable of being brought into contact with and spaced apart from the sheet feeding roller 28 by a separating roller release shaft 244 and a control cam (not shown). The positions of the pressure plate 21, the returning lever 22 and the separating roller 241 are detected by an auto sheet feeder (ASF) ~~sensor~~, ~~not shown~~ sensor (~~not shown~~). Also, the returning lever 22 for returning the sheet material P to the stacking position is pivotally mounted on the base 20, and is biased in a releasing direction by a returning lever spring (not shown). This returning lever 22 is designed to be rotated by the aforementioned control cam (not shown) when it returns the sheet material P to the stacked position.

The paragraph starting at page 17, line 6 and ending at page 18, line 3 has been amended as follows.

Description will hereinafter be made of a state in which sheet feeding is effected by the use of the above-described construction. In an ordinary standby state, the pressure plate 21 is released by a pressure plate cam (not shown), and the separating roller 241 is released by the control cam (not shown). Further, the returning lever 22 returns the sheet material P to the stacking position and is in the state of the stacking position in which it closes a stacking post so that the sheet materials P may not enter the inner part during

stacking. When sheet feeding is started from this state, the separating roller 241 is first brought into contact with the sheet feeding roller 28 by the driving of a motor. The returning lever 22 is then released and pressure plate 21 comes into contact with the sheet feeding roller 28. In this state, the feeding of the sheet materials P is ~~stated~~ started. The sheet material P is limited by an auto-stage separating portion (not shown) provided on the base 20 and only a predetermined number of sheet materials P are fed to a nip portion formed by the sheet feeding roller 28 and the separating roller 241. The fed sheet materials P are separated by this nip portion and only the uppermost sheet material P is conveyed (fed).

The paragraph starting at page 19, line 13 and ending at page 20, line 1 has been amended as follows.

In the above-described construction, the sheet material P fed to the sheet conveying portion 3 is guided to the pinch roller holder 30, and is conveyed to the pair of rollers comprising the conveying roller 36 and the pinch roller 37. At this time, the leading edge of the conveyed sheet material P is detected by the PE sensor lever 321 to thereby ~~finds~~ determine a recording position (a printing position or an image forming position) for the sheet material P. Also, the sheet material P is conveyed on the platen 34 by the pair of rollers 36 and 37 being rotated by a conveying motor 35. The driving of the conveying roller 36 is effected by the rotational force of the conveying motor 35 comprising a DC

motor being transmitted to a pulley 361 provided on the shaft of the conveying roller 36 by a timing belt (not shown).

The paragraph starting at page 20, line 2 and ending at line 21 has been amended as follows.

Also, a code wheel 362 for detecting the amount of conveyance by the conveying roller 36 is provided on the shaft of the conveying roller 36. This code wheel 362 is formed with markings at a pitch of 150 lpi to 300 lpi. An encoder sensor 363 for reading the markings is mounted on a region of the chassis 11 which is adjacent to the code wheel 362. An ink jet recording head is used as the recording means (recording head) 7. A discrete ink tank 71 is interchangeably mounted on this recording head 7 for each ink color. Also, this recording head 7 can give discharging heat energy to the ink by a heater (heat generating element) or the like driven on the basis of recording data. The ink is film-boiled by this heat (discharging energy), and design is made such that by a pressure change caused by the growth or ~~construction~~ contraction of a bubble by this film boiling, the ink is ~~discharge~~ discharged from the discharge port of the recording head 7, and an image is formed on the sheet material P by the discharged ink drop.

The paragraph starting at page 23, line 2 and ending at line 17 has been amended as follows.

In the above-described construction, when an image is to be formed on the sheet material P, the sheet material P is conveyed to the position of a line to be ~~recording~~ recorded (a position in the conveying direction of the sheet material P) by the pair of rollers (conveying roller and pinch roller) 36 and 37 and also, ~~any~~ the carriage 50 is moved to a recording (image forming) start position by the carriage motor 54 to thereby oppose the recording head 7 to a recording position (image forming position). Thereafter, in operative association with the main scanning movement of the carriage 50, the recording head 7 discharges the ink toward the sheet material P by a signal from the electrical portion (electrical substrate) 9, whereby recording (image forming) is effected.

The paragraph starting at page 23, line 19 and ending at page 24, line 12 has been amended as follows.

The sheet discharging portion 4 is provided with two sheet discharging rollers 40, 41, spurs 42 abutting against the sheet discharging rollers 40, 41 under a given pressure to be thereby rotatable, and a gear train for transmitting the driving of the conveying roller 36 to the sheet discharging rollers 40, 41 (Fig. 3). The sheet discharging rollers 40 and 41 are mounted on the platen 34. The sheet discharging roller 40 upstream with respect to the conveying direction is comprised of a metal shaft and a plurality of rubber portions (sheet discharging roller rubber) 401 provided thereon. The sheet discharging roller 40 is driven by the drive from the conveying roller 36 being [[to]] transmitted thereto through an idler gear. The sheet discharging roller 41 is of a

construction in which a plurality of elastic members 411 of elastomer or the like are mounted on a shaft of resin. The sheet discharging roller 41 is driven by the drive being transmitted thereto from the sheet discharging roller 40 through an idler gear.

The paragraph starting at page 29, line 6 and ending at line 13 has been amended as follows.

Each tube pump portion 610 is designed to generate negative pressure in each tube 616 by the tubes 616 disposed along the arcuate guide surface 601 being squeezed by pressing rollers (pump rollers) 614 rotatably ~~journalled~~ journalled to a rotary member (a pump roller wheel 612, a pump roller holder 613) rotatably ~~journalled~~ journalled to a tube guide 611 as a rotary member supporting member.

The paragraph starting at page 29, line 14 and ending at page 30, line 1 has been amended as follows.

That is, a plurality of pressing rollers 614 for generating negative pressure in the tubes 616 are movably supported along the slot-shaped guide groove of the pump roller holder 613, and each pressing roller 614 is biased in a tube pressing direction by a roller spring (pump spring) 615. During the sucking operation of generating negative pressure in the pump tubes 616, the pressing rollers 614 are operated so as to crush (squeeze) the pump tubes 616 while being rolled and rotated (rotated and revolved), and during the ~~other~~ time

other than the sucking operation the pressing rollers 614 are adapted to be retracted from the pump tubes 616. Two pressing rollers 614 are disposed for each of the two pump tubes 616, and thus, four pressing rollers 614 in total are disposed.

The paragraph starting at page 32, line 19 and ending at page 33, line 19 has been amended as follows.

As one of the features of the discharge recovering apparatus 6 to which the present invention is applied, there is provided a bearing portion 6113 for journalling the pump roller wheel 612 to the tube guide 611 as a rotary member supporting member. In contrast, in the conventional discharge recovering apparatus, there has been provided a bearing portion for journalling a rotary member (pump roller wheel) to the recovering base itself. The recovering base is a part of which high rigidity and dimensional accuracy are required as a structure of the discharge recovering apparatus and therefore, a material having glass mixed therewith has been used for it, and the recovering base has been poor in slidability and the application of grease or the like thereto has been necessary. In the discharge recovering apparatus 6 according to the embodiment of the present invention, the tube guide 611 as the rotary member supporting member is made of a material such as POM excellent in slidability, whereby it is possible to construct a tube pump which can satisfy the performance as a bearing including a low sliding load and high durability during the sucking operation and at the same time, ~~in which~~ this bearing can be formed integrally

with the tube guide 611 and accordingly, ~~which~~ can omit the necessity of application of grease or the like without ~~the necessity of especially~~ providing a special bearing part.

The paragraph starting at page 38, line 11 and ending at page 39, line 7 has been amended as follows.

Also, from the point that the number of discharge ports is small, it is necessary that the negative pressure generated by the suction means (tube pump) 61 which is required during ink suction be set to a small level, and it is required to use suction tubes (pump tubes) 616 having a small inner diameter. Another form of discharge recovering apparatus 6 shown in Fig. 12 is adapted to be ~~constructible~~ constructed simply by changing only the rotary member supporting member (tube guide) 611 and the pump tubes 616 in the tube pump shown in Figs. 10 and 11. Also, in the tube pump (suction means) 61 of the discharge recovering apparatus 6 of Fig. 12 used for the caps 621a and 621b having two hermetically sealed spaces, as shown in Fig. 13, the joint portion 6112 of the rotary member supporting member 611 is formed so as to have a small diameter correspondingly to the pump tubes 616 having a small inner diameter, and two such joint portions 6112 are provided, and two joint tubes 626 are individually connected to the two joint portions 6112. That is, from the two joint portions 6112, the pump tubes are connected to the two hermetically sealed spaces of the caps 621 by the two joint tubes 626.

The paragraph starting at page 39, line 23 and ending at page 40, line 16 has been amended as follows.

According to the tube pump 61 as the suction means of the discharge recovering apparatus 6 according to the above-described embodiment, in a tube pump wherein the tubes 616 disposed along the arcuate guide portion 601 are squeezed by the rotary member 612 rotatably journalled to the rotary member supporting member 611 and the pressing rollers 614 rotatably journalled to the pump roller holder 613 pivotally supported on the rotary member 612 to thereby generate negative pressure in the tubes, there is adopted a construction in which the tubes 616, the pressing rollers 614, the rotary member 612, the pump roller holder 613 and the rotary member supporting member 611 are assembled to thereby form the pump unit 61, and are made separable from the guide portion 601 in the state of the pump unit. Therefore, there is obtained the effect that the incorporation of the pump tubes 616 becomes easy and the erroneous incorporation of ~~incorporating~~ the tubes in their buckled state or their twisted state can be eliminated easily.

The paragraph starting at page 45, line 3 and ending at line 25 has been amended as follows.

In Figs. 4 to 13, the capping means 62 is comprised of a cap 621 (including caps 621a and 621b for forming individual hermetically sealed spaces) contacting with the discharge port surface (the ink discharge surface formed with discharge ports) of the

recording head 7, a cap absorbing member 622 for efficiently sucking the ink discharged from the discharge port surface of the recording head 7, a cap holder 623 for supporting the cap 621, and bringing the cap 621 into pressure contact with the discharge port surface 621 of the recording head 7 by a cap spring 624, the cap spring 624 for giving cap pressure (the closely contacting force of the cap) to the cap holder 623, a cap base 625 which is a lift lever for supporting the cap spring 624 and supporting the cap holder 623 for sliding movement in a vertical direction, and bringing the cap 621 into contact with and away from the discharge port surface of the recording head 7, a joint tube for connecting the interior of the cap 621 and the tube pump 61 together, and a valve tube 627 for connecting the interior of the cap 621 and an openable and closable valve 64 for opening ~~the~~ to atmosphere together.

The paragraph starting at page 45, line 26 and ending at page 46, line 17 has been amended as follows.

The valve 64 is comprised of a valve lever 642, valve rubber 643 and a valve lever spring 644, which are assembled to a valve base 641. The valve lever 642 is rotatably journaled to the valve base 641. A tube path is formed in the interior of the valve lever 642, and one end portion thereof is a joint portion for connecting it to the valve tube 627, and the other end portion thereof is an openable and closable valve portion adapted to be brought into contact with and away from the valve rubber 643 by the rotation of the valve lever 642 to thereby change over the opened and closed states of the tube path

of the valve 64. The valve lever spring 644 biases the valve lever 642 in a direction to abut against the valve rubber 643. By the valve 64 being opened and closed, the interior of the cap 621 connected thereto by the valve tube 627 can be ~~changeover~~ changed over so as to be opened and hermetically sealed relative to the atmosphere.

The paragraph starting at page 49, line 23 and ending at page 50, line 17 has been amended as follows.

Thereafter, the cam 65 is rotatively driven by the recovering motor 691 to thereby bring the capping means 62 into contact with the discharge port surface of the recording head 7. The direction of rotation of the pump roller wheel 612 in that case is a direction of rotation R indicated in Fig. 8 and therefore, the pressing rollers 614 of the suction means 61 are disposed at locations spaced apart from the pump tubes 616 to thereby communicate the interior of the cap with the atmosphere. That is, by the interior of the cap being communicated with the atmosphere, even if the pump roller wheel 612 is rotated, the inks residual in the pump tubes 616 will not flow back into the cap 621 and it will never happen that positive pressure is applied to the interior of the cap to thereby ~~give~~ damage to the discharge ports of the recording head 7. After the cap 621 is brought into contact with the discharge port surface of the recording head 7, the recovering motor 691 is forwardly rotated to thereby rotatively drive the pump roller holder 612 in a direction of rotation L in Fig. 8.

The paragraph starting at page 54, line 18 and ending at page 55, line 13 has been amended as follows.

In a discharge recovering apparatus 6 according to a modification of the embodiment shown in Figs. 12 and 13, design may be made such that the rotary member supporting member (tube guide) 611 is partly changed and the inner diameters of the mounted two pump tubes 616 are made different from each other, to thereby provide a great difference in the negative pressure acting on the two hermetically sealed spaces of the cap 621. Whereby, the suction of the recording head 7 is effected with a proper suction force necessary for the drawing-out of the inks from the discharge ports so as to be capable of coping with a recording head portion using a discharge port having a large discharge port diameter as for the ~~block~~ black pigment ink and a recording head portion using discharge ports having a small discharge port diameter as for the dye inks. Also, design may be made such that the number of pump tubes in the discharge recovering apparatus 6 according to the modification of Figs. 12 and 13 is decreased from two to one to thereby cause small negative pressure to act on a hermetically sealed space and cope with a head 7 capable of sucking.

The paragraph starting at page 56, line 16 and ending at page 57, line 8 has been amended as follows.

Further, the present invention can be likewise applied to ~~whatever~~ any arrangement and construction of a recording head and an ink tank, such as a construction in which use is made of an interchangeable cartridge comprising a recording head and an ink tank made integral with each other, or a construction in which a recording head and an ink tank are made discrete from each other and are connected together by an ink supplying tube or the like, and can obtain a similar effect. The present invention can also be applied to a case where an ink jet recording apparatus uses, for example, recording means using an electro-mechanical converting member such as a piezoelectric element, and above all, brings about an excellent effect in an ink jet recording apparatus using recording means of a type discharging ink by the utilization of heat energy. It is because according to such a type, the higher density and higher definition of recording can be achieved.